Expert Q&A

updated October 6, 2010

Could chemo drugs cause a second malignancy?

Rhonda, Oklahoma

My husband had non-Hodgkins lymphoma in 1990. He was treated with m-BACOD, then switched to CHOP. Now he is diagnosed with adenocarcinoma.
His hematologist said that the chemo drugs long ago were mutagenic (which means what?) and cytotoxic (which means what?) and could have caused this second malignancy. Is this true?

Conditions Expert
Dr. Otis Brawley
Chief Medical Officer,
American Cancer Society

Expert answer

Thanks for your question. I hope your husband is doing well.

It is ironic but true that many cancer chemotherapies are known to cause cancers.

It is something that the physician must consider when recommending treatment. Nurses and pharmacists who mix and administer cancer chemotherapies take precautions to minimize their exposure to these drugs because of the potential for harm.

Most of the drugs that are carcinogenic increase the long-term risk of leukemia and lymphoma by a small margin. Some of these drugs have other significant side effects. Doxorubicin (a part of the m-BACOD and CHOP regimens) can cause congestive heart failure as well as leukemia. Some drugs such as cyclophosphamide (the "C" in CHOP and in m-BACOD) increase the risk of bladder cancer because the kidney filters them into the urine and the drug can sit in the bladder. This is one of the reasons

some chemotherapies are given with lots of hydration. It flushes these drugs out and decreases the bladder's exposure.

A mutagen is a physical force that damages genetic material (DNA). The physical force can be radiation or a chemical. The change in genetic material is called a mutation, and things that can change genetic material are call mutagenic. For example, sunlight is mutagenic. It can damage the genetic material of skin cells, and this damage sometimes leads to skin cancer.

Genetic material controls the functions of the cell that it is in. When damaged, the genes usually cause the cell to die. Occasionally, when there is specific damage to a certain gene, the cell can start undergoing uncontrolled reproduction. The immune system also is on the lookout for aberrant cells and will attack them if found. A cell with a mutation that does not kill itself or does not get destroyed by the immune system can begin dividing and reproducing itself. Cancer is the uncontrolled reproduction of cells.

Cancer chemotherapies get into a cell that is undergoing uncontrolled growth and damage the cell so that it can no longer reproduce itself. A drug that damages a cell in order to kill it is called cytotoxic. These drugs do this through various means. The taxanes, used in a number of cancers such as breast and lung cancer, interfere with the gene structure. Some common drugs interfere with a cell's genes. The platinum analogues such as cis-platinum actually bond to genetic DNA and end up breaking the genetic strand. Similarly doxorubicin, etopiside and cyclophosphamide are commonly used chemotherapy drugs that can damage the DNA chain.

It is difficult to say with certainty that a person with a past history of cancer got a newly diagnosed adenocarcinoma because of chemotherapy.

There are several studies in the literature that tell us that people who get cancer are at a higher risk for getting a

second cancer. This is true even among those who are not treated with cancer chemotherapies. Some estimate that 20 percent of long-term cancer survivors eventually develop a second cancer.

The higher risk is due to the fact that people who get cancer have demonstrated a problem in their genes. An identical copy of the problematic genes is in every cell of the patient's body. These other genes are at risk of losing control and developing a cancer. Also, cancer patients may get cancer because their immune system is not able to conduct good surveillance for aberrant cells and destroy them.